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ABSTRACT

The quest for the inclusion of science inquiry in the curriculum now spans three centuries. In the late 1800s and early 1900s, Armstrong, Dewey, and others espoused the teaching of science inquiry. The launch of Sputnik in 1957 began the strong emphasis on inquiry. Renewed interest in inquiry occurred in the late 1980s and 1990s with science inquiry being stressed as a key component in curriculum reform efforts. In this research, a holistic method for teaching science inquiry was utilized; the process skills were linked to each other. Factor analysis indicates the extraction of one primary component for the science inquiry skills. There was a qualitative difference between how students in the two groups approached designing an experiment. The students in the experimental group linked the process skills in a coherent whole; whereas, the control group used a piecemeal approach with each step considered separately. (Author)

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Linking Science Inquiry Skills in a Holistic Approach

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National Conference
Philadelphia, Pennsylvania
March, 2003

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Linking Science Inquiry Skills in a Holistic Approach
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Abstract
The quest for the inclusion of science inquiry in the curriculum now spans three centuries. In the late 1800s and early 1900s, Armstrong, Dewey, and others espoused the teaching of science inquiry. The launch of Sputnik in 1957 intensified the focus on science education, and the reform efforts of the 1960s began the strong emphasis on inquiry. Renewed interest in inquiry occurred in the late 1980s and 1990s with science inquiry being stressed as a key component in curriculum reform efforts. In this research, a holistic method for teaching science inquiry was utilized; the process skills were linked to each other. Factor analysis indicates the extraction of one primary component for the science inquiry skills. Students in the experimental group learned to link science inquiry skills using the holistic method. There was a qualitative difference between how students in the two groups approached designing an experiment. The students in the experimental group linked the process skills in a coherent whole; whereas, the control group used a piecemeal approach with each step considered separately.

Linking Science Inquiry Skills in a Holistic Approach

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Objective of Study

The objective of this research was to assess a holistic method for teaching science inquiry where the process skills were linked to each other in a coherent whole. A quasi-experimental research design was utilized to answer the research questions. The primary research questions were: Does factor analysis indicate the extraction of one primary component for the Science Inquiry Skills Assessment? Is there evidence to support that students in the experimental group have learned to link science inquiry skills? Is there evidence to indicate a qualitative difference between how students in the experimental group and the control group approach designing an experiment?

Significance of Study

Science inquiries that were part of the science curriculum resulting from the 1960s curriculum reform efforts were primarily structured inquiries of the confirmation type with few, if any, guided or open inquiries. When very open types of inquiry such as discovery were used, results indicate that students did not usually progress to higher level process skills (Gabel, 2001).

Today, curriculum reform efforts are stressing the importance of science inquiry skills, but most of the curriculum that is available is not geared to teach open inquiry skills to students. Teaching individual science inquiry skills such as observation and measurement and then trying to get students to link them for an open inquiry has not worked. The current knowledge of how to promote science inquiry is limited (Fradd & Lee, 1999); the development and application of science inquiry remain problematic (Germann, Aram, & Burke, 1996), and few programs have been able to encourage inquiry learning with student-designed experiments (Pizzini, Shepardson, & Abell, 1991).

This study successfully uses a holistic method for teaching science inquiry and tests the construct validity of the science inquiry skills assessment that was used in this research. Factor analysis supports one major factor for science process skills, thus indicating that they are linked. Qualitative results from student work, video tapes, teacher interviews, classroom observations, and an inquiry assessment affirm the linkage of science inquiry skills. Teaching science inquiry using a holistic method with science inquiry skills linked is different than previous methods. This research then provides a successful approach for teaching science inquiry for the new millennium.

Conceptual Framework

Researchers (Roth & Roychoudhury, 1993; Roth & Bowen, 1993; Helgeson, 1994; Jackson, Stratford, Krajcik, & Soloway, 1994) stress integrated science inquiry skills. If the inquiry skills are truly integrated, then the performance of each skill is dependent upon the preceding skill; and thus, the skills are linked like a chain. Previously, teachers have taught individual inquiry skills, and it was believed that by teaching the individual skills, starting from the simplest skills such as observing and measuring, the skills could then be linked so that students could learn to do more complex tasks such as design an experiment. This approach was not successful in teaching students to design their own inquiries. Instead of building interrelated science concepts, inquiry often became a series of meaningless hands-on activities (Mintzes & Wandersee, 1998). Perhaps, past attempts at science inquiry failed to achieve the intended results because of the failure to recognize that science inquiry skills are linked to each other.

Research (Baird & Borich, 1987, 1989; Roth, 1989) indicates that science inquiry skills are all part of the same underlying construct. Roth (1989) analyzed data from Baird and Borich (1987, 1989) using confirmatory factor analysis to determine construct validity with the Test of Integrated Process Skills (TIPS) for secondary science students (Dillashaw & Okey, 1980) and the Group Assessment of Logical Thinking Test (GALT). The Roth analysis supports one factor for the process skills contained in TIPS. Although constructs of formal reasoning ability and integrated science process skills as measured by written tests share much common variance, the critical question is whether science process skills and formal reasoning ability are one and the same (Baird & Borich, 1987, 1989).

Integrated science process skills and formal reasoning ability correlate highly within individuals, and the high correlation may be a reflection of their similarity in cognitive structure (Baird & Borich, 1987, 1989; Roth, 1989). Science process skills originate from the science education community and formal reasoning ability comes from educational psychology. Therefore, the separate origins contribute to efforts to design separate assessment instruments, but these assessments may indeed measure the same trait (Baird & Borich, 1987).

The previous major curriculum reform of the 1960s attempted integration by involving educational psychologists such as Bruner, Schwab, and Gagne in curriculum development. Bruner stressed a child-centered approach of learning science through discovery (Bruner, 1961). Schwab emphasized imparting the excitement of science, an appreciation for major concepts, and methods of science inquiry (Mintzes & Wandersee, 1998). The open-ended laboratory investigation was envisioned by Schwab as a means for asking questions, making observations, recording data, and making conclusions. According to Schwab, teaching students to act like a scientist by mastering techniques and collecting data ignored the importance of interpreting the data and making conclusions (Schwab, 1964).

Gagne also stressed inquiry, and his work on inquiry methods had a substantial impact on science curriculum reform efforts of the 1960s. Gagne's hierarchy of learning levels theorizes that the learning of complex skills depends upon the learning of a hierarchy of increasingly more complex skills. The greatest criticism of Gagne's scheme was its failure to help children build frameworks of interrelated science concepts. Thus, students did a series of activities which they failed to connect with meaningful content. The pursuit of science inquiry fell far short of the intended goal.

Therefore, the quest for the inclusion of science inquiry in the curriculum now spans three centuries. In the late 1800s and early 1900s, Armstrong (1903), Dewey (1916), and others espoused the teaching of science inquiry. The launch of Sputnik in 1957 intensified the focus on science education, and the reform efforts of the 1960s began a strong emphasis on inquiry. The renewed interest in inquiry that occurred in the late 1980s and 1990s stresses science inquiry as a key component in curriculum reform efforts such as the *National Science Education Standards* (National Research Council, 1996), *Science for All Americans* by the American Association for the Advancement of Science (1989), and the Scope, Sequence, and Coordination model endorsed by the National Science Teachers Association (Aldridge, 1996). The Association for Supervision and Curriculum Development (2002) asserts that science literacy includes the ability to design and conduct experiments and investigations. Consequently, a better understanding of how to teach science inquiry is needed.

Design and Procedure

This research study has a quasi-experimental design with a treatment group and a control group. The subjects of this study are 300 middle school students from two urban school districts in a major metropolitan area in the western United States. The students in this study are nested in teaching method. There are three different schools involved in the treatment group, and students from these schools who are at the same level form the control group. Extra attempts were made to keep the two groups as similar as possible except for the teaching method for science inquiry.

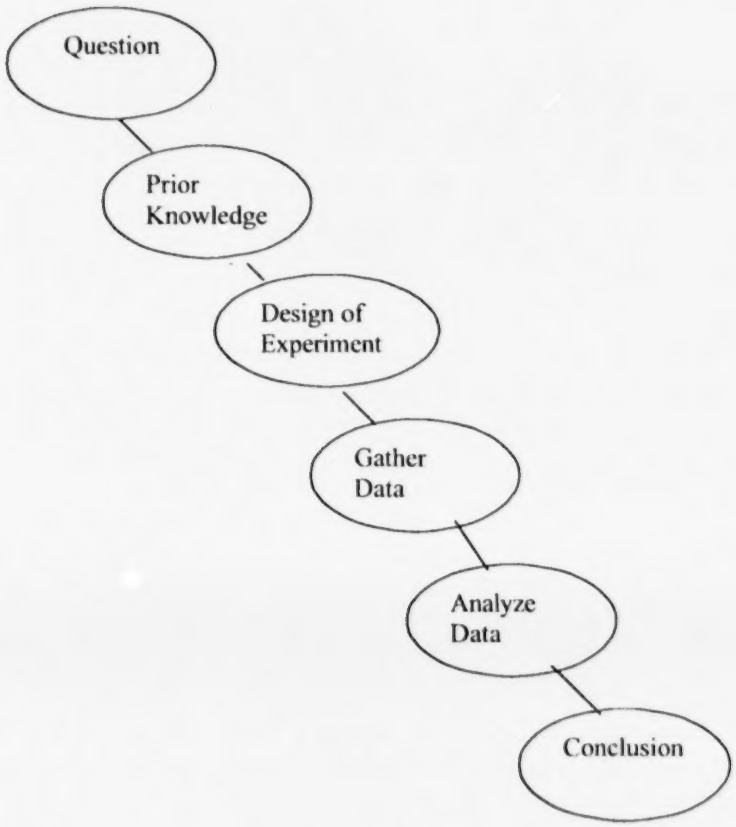
The Science Inquiry Skills Assessment (SISA) (Gabel, 2001) was constructed by adapting items from the Test of Enquiry Skills (TOES) (Fraser, 1979), the Performance of Process Skills Test (POPS) (Pottenger, Mattheis, Jones, & Nakayama, 1988), and the Iowa Process Instrument for Grade Levels 4-12 (Iowa) (Tamir, Yager, Kellerman, Blunck, 1991; Enger & Yager, 1998). The SISA instrument consists of thirty-four multiple choice items where there is one best choice for the answer. Items were designed to test the range of inquiry skills used in the study. Students were encouraged to answer each item with their best choice.

The content validity of the SISA was estimated by having three science experts review the test for science content. An expert in mathematics reviewed the test for math content, and two teachers reviewed the instrument for age appropriateness. An expert in measurement reviewed the instrument's construction, and revision suggestions were followed to develop the final version used in the study. The Flesch Reading Ease of the SISA is 78.8, and the instrument has a Flesch-Kincaid grade level readability of 4.8.

Factor analysis was used to estimate construct validity. This statistical technique was used to determine the identification of factors that represented the relationships among the set of SISA questions. The principal component analysis extraction method was used to determine the number of major factors. A scree plot was used to provide a graphical representation of the factors extracted. A component matrix contributed further information about the relationships among the SISA questions.

Students in the experimental group learned to design an experiment using a holistic approach where the science inquiry skills were taught as a schema with the steps linked into a coherent whole. The schema was posted in each experimental classroom, and each teacher in an experimental classroom used the exact same schema and also taught the steps in the schema as a coherent whole where each step was linked to the other steps. Thus, the steps were systematically linked to each other similar to links in a chain as is shown in Figure 1.

Figure 1—Linking Science Inquiry Steps



For each experiment, students wrote each step and systematically linked the parts together to form the experiment. The teachers worked to help the students understand how the steps needed to be linked to each other. For example, the students wrote a question at the beginning of the experiment. The design of the experiment revolved around how to answer this question. The data table was based on the design of the experiment. The analysis was linked to the data which was linked to the design which was linked to the question. Finally, the conclusion answered the question that was asked at the beginning of the experiment. The teachers taught the students how the entire experiment fit together. Although this may seem similar to how students have been taught previously, it is vastly different in the approach and in the results obtained.

Results of Study

Factor analysis of the science inquiry skills assessment reveals the extraction of one major factor using the principal component analysis method. This factor has an eigenvalue of 5.03 and nearly all of the science inquiry skill questions loaded on this main component. If a case could be made for a second factor, the eigenvalue is much lower at 2.129 and only five of the questions, all in the last quarter of the assessment, loaded on this component. Other possible factors had eigenvalues of 1.5 or less and only had a loading of one or two questions with the exception of one possible factor with a loading of four questions, involving a number of different inquiry skills. Various rotations were attempted. Orthogonal rotations using the Varimax and Quartimax methods failed to converge in twenty-five attempts. Oblique rotations using Promax, and Direct Oblimin methods also failed to converge in twenty-five attempts. This research, therefore, indicates the extraction of one major factor and provides support that science inquiry skills are linked.

Qualitative data from student work, video tapes, teacher interviews, classroom observations, and an inquiry assessment indicate that students in the treatment group approached their experimental designs in a holistic manner, and they linked one step to the next to form a complete whole. One of the teachers in the treatment group concluded that depth of understanding through the high level of questions by teachers contributed to the holistic manner in which students viewed the experiments (Gabel, Buckley, Hassler, Muller, & Marlow, 2000). This teacher's comment is as follows: "higher level questions led the students to view things more holistically."

However, the students in the control group had much more difficulty including the details necessary for actually conducting an experiment. The students in the control group had an idea about how they could design an experiment, but because they left out many details, their experiments were more fragmented than those of the treatment group. Also, the control group often could not use their prior knowledge to help them design an experiment, and this step was frequently left out. Therefore, the control group students had more difficulty linking one step to the next to form an experiment with sufficient details such that another student could actually conduct an experiment with their design.

For this research study, it was not feasible to have 300 students conducting the inquiry they designed; therefore, because students do not actually conduct this experiment, they do not analyze the data nor make a conclusion. This format was standard across all participants in the research study in both the pre- and post-assessments. Even though the assessment for ability to design an experiment did not ask students for an analysis nor a conclusion since they did not have data, many students in the treatment group wanted to include these two steps. They expressed a need to include these steps so that their experimental design would be complete and because they were accustomed to including these two steps. Many students even created data so that they could include a data analysis and a conclusion, but this was rare in the control group. An insistence on using the complete schema indicates that the steps are linked for the students in the treatment group.

However, the control group students had more difficulty linking one step to the next to form an experiment with sufficient details such that another student could actually conduct an experiment with their design. Figure 2 is one of the best experimental designs from the control group. This student describes the things that she thinks about doing, but she does not give sufficient details for another student to repeat the experiment, nor does she link this experiment to any prior knowledge about feeding fish.

In contrast, the student from the treatment group (Figure 3) included many details with steps numbered: 1) Get a lamp and a long cord. 2) Measure on the floor 6 meters. Mark the floor each meter with tape. 3) Start at 6 meters with the light in your hand. Observe the fishes' behavior. Record it. 4) Keep moving forward, observing and recording. 5) Then see when the fish noticed the light. This student's data table is linked exactly to the design of the experiment with a column for distance in meters with a separate line for every meter mark from 6 meters to 0 meters. A second column in the data table is labeled observations that also links directly to the student's experimental design. Likewise, the graph axes are labeled with the x-axis for each meter mark, and the y-axis with the number of fish noticing the light. This student has used a holistic approach with each stepped linked to the previous one.

Figure 2—Control Group Experimental Design

Fish Light

Can Fish tell the Differnece in Dark and Light?

I would Put 5 Different fish in 3 tanks One in Regular Light one Tank in Dim Light and the last tank in the Dark I would Record their Behavior I would also Feed them The same amount of food and See if they eat Diffrinly after on week I would Rotate the tank for 3weeks until every tank has Been Regular Light, Dim Light and Dark

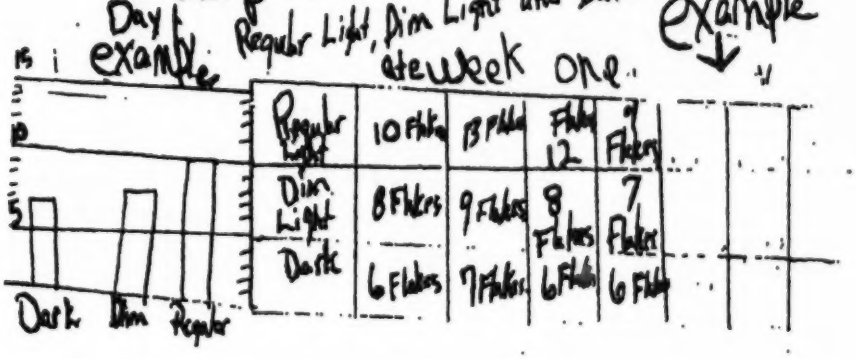


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Figure 3—Treatment Group Experimental Design

Motion Light experiment #1

Question: How far away can the fish detect light?

Prior knowledge: I know the fish detect motion close up and not far away.

Design of experiment:

1. Get a lamp and a long cord.
2. Measer on the floor 6 meters, Mark the floor each meter with tape.
3. Start at 6 meters with the light in your hand. Observe the fishes behavior. Record it.
4. Keep moving forward, observing and recording.
5. Then see when the fish noticed the light.

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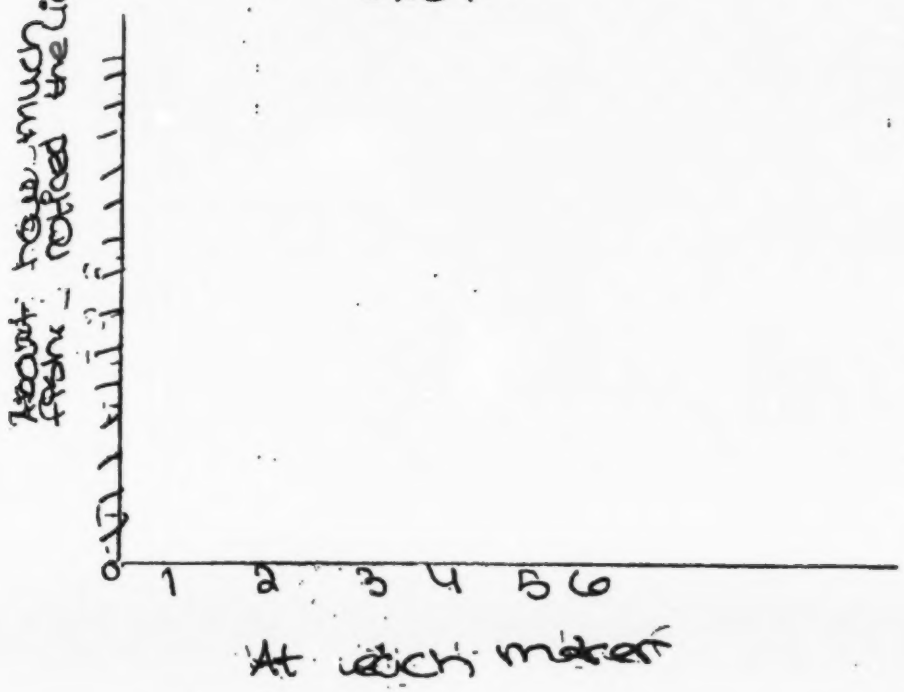
Figure 3 (Cont.)

Data Table

Meters	Observations
6 m.	
5 m.	
4 m.	
3 m.	
2 m	
1 m	
0 m	

Graph



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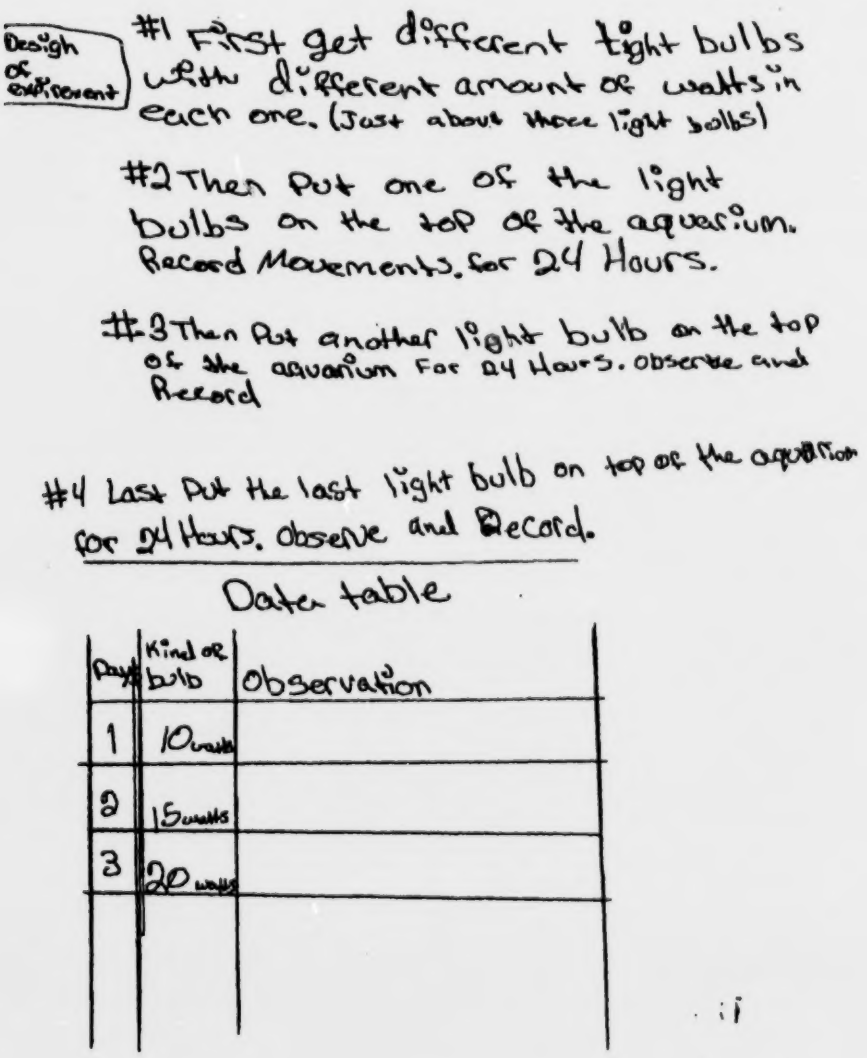
In the second example, only the student's design of experiment step is provided in Figure 4 to illustrate the level of detail from the treatment group. This student has also numbered her steps. Step #1: First get different light bulbs with different amount of watts in each one. (Just about three light bulbs) Step #2: Then put one of the light bulbs on the top of the aquarium. Record movements for 24 hours. Step #3: Then put another light bulb on the top of the aquarium for 24 hours. Observe and record. Step#4: Last put the last light bulb on top of the aquarium for 24 hours. Observe and record. Her data table indicates that she will use 10 watts on day one, 15 watts on day two, and 20 watts

Figure 4—Treatment Group, Student #2
Design of Experiment Step

on day 3. Again, like the other student in the treatment group, this student has linked her


Design of experiment
#1 First get different light bulbs with different amount of watts in each one. (Just about three light bulbs)
#2 Then put one of the light bulbs on the top of the aquarium. Record Movements for 24 Hours.
#3 Then Put another light bulb on the top of the aquarium For 24 Hours. observe and Record
#4 Last Put the last light bulb on top of the aquarium for 24 Hours. observe and Record.
Data table
Day #
Kind of bulb
Observation
1
10 watts
2
15 watts
3
20 watts

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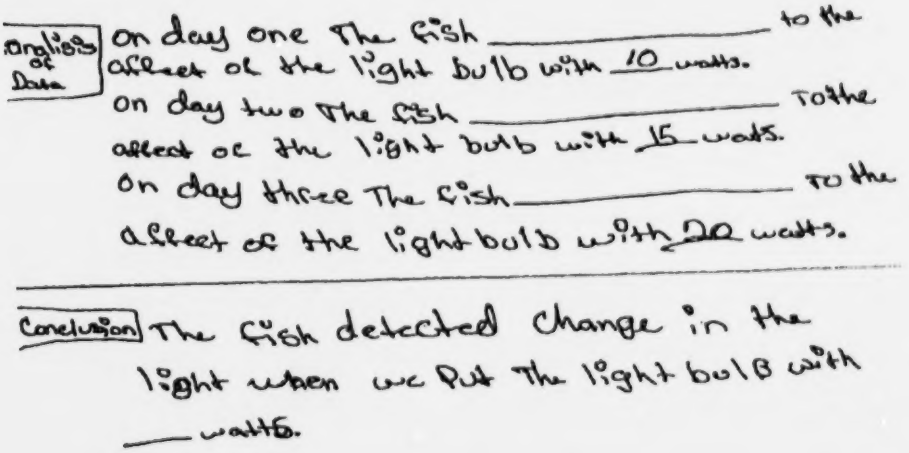
steps in the design of the experiment to her data table and her holistic approach is evident.

Even though the assessment for ability to design an experiment did not ask students for an analysis nor a conclusion since they did not have data, many students in the treatment group wanted to include these two steps. They expressed a need to include these steps so that their experimental design would be complete and because they were accustomed to including these two steps. Figure 5 illustrates a typical student example of this process. Again, a desire to use the complete schema indicates that the steps are linked for the students.

Figure 5—Inclusion of Analysis and Conclusion Steps
Student Work from Treatment Group


Analysis of Data
On day one The fish _____ to the affect of the light bulb with 10 watts.
On day two The fish _____ To the affect of the light bulb with 15 watts.
On day three The fish _____ to the affect of the light bulb with 20 watts.
Conclusion
The fish detected change in the light when we Put the light bulb with ___ watts.

Conclusions and Implications

Previous methods of teaching science inquiry by requiring students to learn measurement and observations skills and expecting them to be able to conduct an inquiry after they had learned the required individual skills has not worked. However, the method used in this research study where the science inquiry skills were purposefully linked was successful. Furthermore, the factor analysis results of the science inquiry skills assessment reveals the extraction of one major factor using the principal component analysis method. Both the statistical analysis and the qualitative results support the same conclusion—the science inquiry skills are linked in this research study. Since the approach used in this research study was successful in teaching students to design experiments (Gabel, 2001), deliberate linkage of science inquiry skills appears to be a key component that contributed to its success.

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References

Aldridge, B. C. (Ed.) (1996). Scope, sequence, and coordination: A framework for high school science education. Washington, DC: National Science Teachers Association.

American Association for the Advancement of Science (AAAS). (1989). Science for all Americans. Washington, DC: AAAS.

Association for Supervision and Curriculum Development (ASCD). (2002). Curriculum Handbook: Science. Alexandria, VA: ASCD.

Armstrong, H. E. (1903). The teaching of scientific method and other papers on education. London: Macmillan.

Baird, W. E., & Borich, G. D. (1987). Validity considerations for research on integrated science process skills and formal reasoning ability. Science Education, 71(2), 259-269.

Baird, W. E., & Borich, G. D. (1989). Authors' response to "confirmative factor analysis for validity consideration." Science Education, 73(6), 657.

Bruner, J. S. (1961). The act of discovery. Harvard Educational Review, 31(1), 21-32.

Dewey, J. (1916). Method in science teaching. General Science Quarterly, 1(1), 3-9.

Dillashaw, F. G., & Okey, J. R. (1980). Test of the integrated science process skills for secondary science students. Science Education, 64(5), 601-608.

Enger, S. K., & Yager, R. E. (1998). The Iowa assessment handbook. Iowa City, IA: The University of Iowa.

Fradd, S. H., & Lee, O. (1999). Teachers' roles in promoting science inquiry with students from diverse language backgrounds. Educational Researcher, 28(6), 14-20.

Fraser, B. J. (1979). Test of enquiry skills handbook. Victoria, Australia: Australian Council for Educational Research Limited.

Gabel, C. (2001). Effectiveness of a scaffolded approach for teaching students to design scientific inquiries. Dissertation. Denver, CO: University of Colorado.

Gabel, C., Buckley, P., Hassler, J., Muller, L., & Marlow, M. (2000, April). Linking science inquiry, process, and content. Paper presented at the National Science Teachers Association, Orlando, FL.

Germann, P. J., Aram, R., & Burke, G. (1996). Identifying patterns and relationships among the responses of seventh-grade students to the science process skill of designing experiments. Journal of Research in Science Teaching, 33(1), 79-99.

Helgeson, S. L. (1994). Research on problem solving: Middle school. In D. L. Gabel (Ed.), Handbook of research on science teaching and learning (pp. 248-268). New York: Macmillan.

Jackson, S. L., Stratford, S. J., Krajcik, J., & Soloway, E. (1994). Making dynamic modeling accessible to precollege science students. Interactive Learning Environments, 4(3), 233-257.

Mintzes, J. J., & Wandersee, J. H. (1998). Reform and innovation in science teaching: A human constructivist view. In J. J. Mintzes, J. H. Wandersee, & J. D. Novak (Eds.), Teaching science for understanding: A human constructivist view (pp. 29-58). San Diego: Academic Press.

National Research Council. (1996). National science education standards. Washington, DC: National Academy Press.

Pizzini, E. L., Shepardson, D. P., & Abell, S. K. (1991). The inquiry level of junior high activities: Implications to science teaching. Journal of Research in Science Teaching, 28(2), 111-121.

Pottenger, F. M., Mattheis, F. E., Jones, M. L., & Nakayama. (1988). Performance of process skills test (POPS). Greenville, NC: East Carolina University.

Roth, W. M. (1989). Confirmatory factor analysis for validity consideration: A critique. Science Education, 73(6), 649-655.

Roth, W. M., & Bowen, G. M. (1993). An investigation of problem framing and solving in a grade 8 open-inquiry science program. The Journal of the Learning Sciences, 3(2), 165-204.

Roth, W. M., & Roychoudhury, A. (1993). The development of science process skills in authentic contexts. Journal of Research in Science Teaching, 30(2), 127-152.

Schwab, J. J. (1964). The teaching of science as enquiry. In J. J. Schwab & P. F. Brandwein, The teaching of science (pp.1-103). Cambridge, MA: Harvard University Press.

Tamir, P., Yager, R. E., Kellerman, L., & Blunck, S. M. (1991). The Iowa assessment handbook. Iowa City, IA: The University of Iowa.

THE ROLE OF SUSTAINED PROFESSIONAL DEVELOPMENT IN SCIENCE TEACHER RENEWAL AND RETENTION

Abstract:

The Texas Regional Collaboratives for Excellence in Science Teaching (TRC) is a sustained professional development program serving over 700 teachers in Texas. The teacher participants receive over 105 contact hours of professional development each year. The purpose of this study was to investigate the role of the TRC professional development program in science teacher renewal and retention. Sixty current and former members of the TRC were intentionally selected and surveyed to determine the impact of the program on science teacher renewal. One-on-one interviews were conducted with selected participants to verify and describe their respective TRC experiences. Study participants averaged 13.4 years of teaching experience and 3.3 years participating in the TRC program. Findings revealed six factors impacting science teacher renewal: Building confidence in teaching ability; providing networking opportunities; creating professional environments; providing leadership opportunities; providing current information on statewide issues; and providing classroom materials. These factors impacting renewal are supported in literature on science teacher retention and renewal.

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